OGDEN CANYON CONDUIT
Ogden Canyon
Weber County
Utah

HAER No. UT-51

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Rocky Mountain Regional Office
Department of the Interior
P.O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD
OGDEN CANYON CONDUIT

HAER No. UT-51

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I. INTRODUCTION

Location:	From the base of Pineview Dam through Ogden Canyon to a surge tank at the mouth of Ogden Canyon where it supplies water to the penstock of the Utah Power and Light Company's Pioneer Station, the Ogden-Brigham Highline Canal and the South Ogden Highline Canal.
Quadrangles:	Ogden, North Ogden, and Huntsville
UTM:	A 12/4567180/428910 B 12/4566020/422260
Construction Dates:	1934-1937 (modified in 1955-57, 1983, 1984, and 1986)
Present Owner:	Ogden River Water Users Association, Ogden, Utah.
Present Use:	The conduit transports water from Pineview Reservoir to the mouth of Ogden Canyon. Forty-four percent of the Ogden Canyon Conduit water is used by Utah Power and Light at their Pioneer Station. The remaining 56 percent is diverted into the Ogden-Brigham Canal and the South Ogden Highline Canal.
Significance:	The Ogden Canyon Conduit is a 75-inch wood-stave pipe constructed by the Bureau of Reclamation with funds obtained from the National Industrial Recovery Act. The Ogden Canyon Conduit is one of the few remaining examples of wood-stave conduit technology once used in Utah.
Historians:	Douglas S. Beckstead Bureau of Reclamation Upper Colorado Region Salt Lake City, Utah, June 1989. Don Southworth Office of Public Archeology Brigham Young University, February 1988.

II. ABSTRACT

The Ogden Canyon Conduit is a wood-stave pipeline (HAER Photos UT-51-4, 12), approximately 5 miles long, extending from Pineview Dam to the penstock of the Utah Power and Light Pioneer Station. The conduit is located approximately 10 miles east of Ogden, Davis County, Utah. The existing conduit was constructed in 1935-36 to replace an earlier conduit dating from 1895.

The conduit derives its significance in part, first, by being one of the only surviving conduits of this type in Utah. Second, the generating facilities associated with the original, and existing conduits were among the the first operations in the United States to produce hydroelectric power.

In addition to generating electricity, the water carried in the conduit is diverted into two canals owned and maintained by the Ogden River Water Users' Association.

Due to the age of the conduit, and the present condition of the structure (HAER Photo UT-51-6), the Bureau of Reclamation and the Ogden River Water Users' Association are undertaking a plan of action to replace the entire length with steel pipe.

III. HISTORY

A. EURO-AMERICAN SETTLEMENT AND THE EARLY NEED FOR WATER

The earliest known Euro-Americans to visit the Ogden Valley were mountainmen searching for beaver and other valuable furs during the early nineteenth-century. Principle among them were Jim Bridger, part of the trapping expedition led by William Ashley, who sighted the Great Salt Lake in the fall of 1824. Ashley's men, during the winter of 1824-25, changed their plans for camping in the Cache Valley because of severe weather, instead establishing two camps on the Great Salt Lake. The group included: William Sublette, Daniel Potts, Johnson Gardner, and John H. Weber, the namesake of the Utah river that bears his name.[1]

Peter Skene Ogden, for whom the Ogden River and the city of Ogden are both named, was part of the Hudson's Bay Company trapping expedition that explored the Wasatch Front during 1825. Unlike Ashley's American Company, the British company consisted of two gentlemen and 71 trappers. They were equipped with 372 horses and 364 beaver traps. During the middle of May, Ogden and his men spent a week in what was called Ogden's Hole (now known as Ogden Valley, located where the Pineview Reservoir is situated) where they trapped 590 beaver. Their presence so far south led to a confrontation with Ashley's men on the Weber River, near Mountain Green. The Americans, under the leadership of Johnson Gardner, claimed the area belonged to the United States and induced

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[1]Richard C. Roberts, Ogden: Junction City (Northbridge, California: Windsor Publications, Inc.), 9-13.

23 of Ogden's men to desert, taking with them about 700 beaver pelts. This led the British company to retrace their steps northward, back into Idaho and Canada. Peter Skene Ogden never made it out of the mouth of the canyon named for him, nor did he see the Great Salt Lake.[2]

John C. Fremont, a government explorer, traveled down the Weber River to the Great Salt Lake in 1843, following paths originally blazed by the mountainmen. His group was responsible for drawing the first accurate maps of the Great Salt Lake and vicinity.[3]

The first permanent Euro-American settlers were the family of Miles Goodyear, a red-headed Connecticut Yankee, who set out on the Oregon Trail in 1836. After being involved in the fur trade, and supplementing his income with horse trading and racing, he married the daughter of a Ute Indian chief, Pe-Teet-Neet, and by 1842 had a son and a daughter. When the fur trade began to dwindle, Goodyear turned to developing a trading and supply station to take advantage of the increasing overland emigration. He chose a location where he could trap, trade horses and raise his family. In 1845, he built Fort Buenaventura on a large sandy hill located on the lower Weber River.[4] The first emigrants to visit Fort Buenaventura arrived during 1846. It was suggested that by traveling around the southern end of the Great Salt Lake,

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[2]Dale L. Morgan, The Great Salt Lake (Albuquerque: University of New Mexico, 1973), 73-76. Also, Roberts, 13.

[3]Roberts, 17.

[4]Roberts, 17-19.

trains would find a shorter route to California. This proved catastrophic for the Donner party when they were waylaid in the Great Salt Lake Desert eventually becoming trapped in the Sierra Nevada Mountains.

The first group of Mormons emigrating to the Great Basin met Goodyear on July 10, 1847 near Sulphur Creek, a tributary of the Bear River. Although he tried to convince them to settle in the area of his fort, the canyon of the Weber River proved too rugged and they continued with their original plans settling in the Great Salt Lake Valley.[5]

Brigham Young, fearing that Fort Buenaventura may become a haven for apostate Mormons, directed Captain Charles Brown, the church's agent, to buy Goodyear out as soon as possible. Brown paid Goodyear $1,950.00 in Mexican or Spanish coins for his fort and supplies, horses and furs not included.[6] When Goodyear moved his family and horses out, Brown moved his in and renamed the fort "Brownsville."[7]

The first irrigation project in the area, undertaken by the Mormons consisted of a small diversion dam on Canfield Creek, which flows from Waterfall Canyon. With this, Brown and his small community were able to plant

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[5]Dale L. Morgan, The Great Salt Lake (Albuquerque: University of New Mexico Press, 1973), 194.

[6]John D. Unruh, Jr., The Plains Across: The Overland Emigrants and the Trans-Mississippi West, 1840-60, 205-206.

[7]Roberts, 19.

5 acres of wheat as well as small patches of corn, turnips, cabbages, potatoes, and watermelons in 1848. The next year, Ezra Chase, Charles Hubbard, and Ambrose and William Snow settled their families at Mound Fort and began irrigating with water from the Ogden River. By 1849, 30 families had moved into the Ogden area.[8] Within the first 50 years, the population had grown to 16,313.[9] The demand for water was not limited to culinary and agricultural uses, but eventually included industrial and electrical production as well.

With the arrival of the railroad in Utah in 1869, Ogden was selected as the location for shops and terminals by both the Union Pacific and Central Pacific Railroads.[10] Because of the rapid industrial growth brought on by the close proximity of the railroads, Ogden quickly grew to become the third largest city in the territory.

The first organized attempt to pipe water from the Ogden River came in 1881. In that year the Ogden Water Company was formed to allow the city to pipe water from Ogden Canyon to a small reservoir located on Courthouse Hill (now 24th Street), constructed 2 years earlier. From there the water was piped throughout the city via distribution lines laid along principle

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[8]Roberts, 20.

[9]Richard D. Poll, et al, eds., Utah's History (Provo, Utah: Brigham Young University Press, 1978), 687.

[10]Leonard J. Arrington, Great Basin Kingdom: An Economic History of the Latter-day Saints, 1830-1900 (Lincoln: University of Nebraska Press, 1966), 265-70.

streets.[11] The final development in Ogden's water supply came in 1914 when the city commenced to exploit the underground water resources in the Weber and Ogden valleys. The town's water supply is primarily from artesian wells located in the lower end of Ogden Valley. Many of these wells, now lying beneath the waters of Pineview Reservoir east of the city, have been capped and piped.[12]

The pipes transported water to the electric powerplant (which will be discussed in the following section), and distributed culinary water throughout the town, and were constructed of wood-staves.[13] Wood was employed because it was "less expensive than galvanized steel and easier to handle."[14] Constructing pipe with wood was a common practice, as evidenced by recorded wood-stave pipes in Ogden, Murray,[15] and Beaver.[16] A similar conduit also ran from the Timpanogas Canal Diversion Dam (at the site of the Jordanelle Dam axis) on the Provo River carrying water to the old Heber City power house,

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[11]Works Progress Administration, A History of Ogden (Ogden, Utah: Ogden City Commission, October 1940), 56. Also, Dale L. Morgan, A History of Ogden (Ogden, Utah: J. O. Woody Printing Co., 1940), 56.

[12]Works Progress Administration, 57.

[13]Ida D. Draayer, South Ogden City: Utah, History, 1848-1984 (Layton, Utah: Candle Graphics, 1985), 225.

[14]Ogden Standard Examiner, August 30, 1987.

[15]Utah Department of Transportation, "Salt Lake City Canal Bridge: Murray via Vine Street-Highland Drive," on file at the Utah State Historical Society, Box 1-5.

[16]Charmaine Thompson, An Archaeological Inventory of the Utah Power and Light Lower Beaver FERC Project 814 Pipeline, Beaver County, Utah, 5-6.

located along US 40, north of Heber City in Wasatch County. The power house is no longer in use and the conduit has been removed.[17]

B. EARLY HYDROELECTRIC POWER GENERATION

The idea of generating electricity with water (hydroelectric) was first developed in Europe. It was later brought to the United States by Edward D. Adams and Coleman Sellers who traveled to Europe "to observe hydraulic developments and methods of transmitting power" in 1889. Three years later, after returning to New York, they placed an order with the Westinghouse Company for generating machinery for a plant they were planning to construct at Niagra Falls.[18]

In 1890, three young engineers named Stillwell, Shallenberger, and Scott, persuaded George Westinghouse (the founder of the Westinghouse Company) to authorize a contract for a hydroelectric plant at Telluride, Colorado. Although limited in size and scope, 100 horsepower with transmission lines extending over 3 miles, the installation was a success with both engineering and commercial impacts.[19] Thomas Edison had been invited to bid on the project, but declined. As a result, the Telluride plant used a generator

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[17]Bureau of Reclamation, Central Utah Project, Bonneville Unit, Municipal and Industrial System, Final Environmental Statement, Vol. 1, October 25, 1979, B-66.

[18]Anonymous, History of the Establishment of Electrical Power Companies in Utah, unpublished manuscript (MS 6291) located in the Historical Department of the Church of Jesus Christ of Latter-day Saints, Salt Lake City, Utah, 14.

[19]Ibid., 15.

producing alternating current (Edison had been advocating direct current). This directed future technological development toward alternating current. Three years later, a second generating plant was built at Redlands, California.[20]

The practical application of electric power to industry in Utah was carried out by L. L. Nunn. He directed the use of electricity in various mining endeavors in both southwestern Colorado and Utah during the early 1890s.[21] However, a practical means of generating electricity and then transmitting it over long distances had not been adequately developed.

According to Dale Morgan, in June 1881 the Ogden Electric Light Company built a steam powered generating plant in Ogden.[22] This plant predated the Niagra Falls experiment and hydroelectric power by nearly 8 years.

On November 27, 1893, 20 days following the construction of the hydroelectric generating plant at Redlands, California, the Pioneer Electric Power company was organized by a variety of Utah business and religious leaders to build a hydroelectric plant and develop power on the Ogden River

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[20]Arrington, 394. The significance of the Utah plants in the development of hydroelectric power in the United States is discussed in John Winthrop Hammond, Men and Bolts: The Story of General Electric (New York, 1941), 232-233, 250-51.

[21]History of the Establishment of Electrical Power Companies in Utah, 17.

[22]Morgan, Ogden, 57.

near the mouth of Ogden Canyon.[23] Company officers included: George Q. Cannon,[24] President; F. J. Keisel, Vice President; Charles K. Bannister, Secretary-treasurer; Frank J. Cannon, General Manager; and Wilford Woodruff,[25] Joseph F. Smith,[26] John R. Winder,[27] Asabel H. Woodruff, and A. B. Patton, Directors.[28]

Raising capital for the new venture proved to be difficult. The Church of Jesus Christ of Latter-day Saints (the Mormons) subscribed for $520,000 (out of $1,000,000) in stock and took an active part in planning the new project.[29] In the spring of 1894, the promoters, lead by Bannister were successful in attracting a New York broker, George A. Purbeck, to the scheme. In addition, two highly acclaimed men, Thomas S. King, consulting engineer of the New York elevated railroads, and Warren H. Loss, an internationally renowned construction engineer began discussions about the project with church leaders. On May 22, 1894, the L.D.S. church agreed to raise $1,250,000 to finance the

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[23]Arrington, 394.

[24]Cannon was the first counselor to the President of the Church of Jesus Christ of Latter-day Saints, Wilford Woodruff, at the time.

[25]Woodruff was the fourth President of the Church of Jesus Christ of Latter-day Saints from 1889-1898.

[26]Smith later became President of the Church of Jesus Christ of Latter-day Saints from 1901-1918.

[27]Winder was appointed first counselor to President Joseph F. Smith in 1901.

[28]The Circuit, October 1955, 6.

[29]Although the stock was listed as fully paid, it appears that most of it was issued as a gift or in lieu of land and water rights the church turned over to the company. See: Arrington, 394.

endeavor. Although the church had agreed to be a financial backer and a variety of European contacts were made, the necessary capital was not raised. The reasons for the failure are two-fold. First, an international economic depression struck from 1893-1894, thus limiting investment finances.[30] Second, the technical possibility of transporting electricity over long distances, in this case, 35 miles from Ogden to Salt Lake City, had not been proven. As a result, some of the engineer-consultants may have advised delaying the project until further development of the technology.[31]

Although it was uncertain at first, if the necessary financial resources could be obtained, plans were developed to construct a concrete dam, a pipeline approximately 6 miles long to the plant site from the dam, and a powerplant capable of producing 10,000 horsepower (7460 kilowatts).[32] While preliminary investigations continued, exploration and development was carried out during 1894 and 1895. Capital was borrowed from local banks, over the signatures of Mormon church officials. During the period, a dam site (HAER Photo UT-51-19) was selected (below the present Pineview Dam) and a contract was let to manufacture and lay the pipeline to supply water to the plant below.[33]

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[30]Dean L. May, "Towards a Dependant Commonwealth," in Poll, 237-38.

[31]Arrington, 394-95.

[32]The Circuit, October 1955, 6.

[33]Arrington, 395.

Actual construction began in the spring of 1895. A machine shop was built to manufacture 6-foot diameter steel pipe. Special planning mills were erected to turn 2 million cubic feet of clear pine (Douglas Fir) timber, imported from Portland and Seattle, into staves for constructing the conduit (HAER Photo UT-51-22) with the same 6-foot diameter as the steel pipe.[34]

The Pioneer Dam was completed in 1898 at a cost of $250,000. According to Richard C. Roberts, the hydroelectric plant supplied electricity to area businesses, at a rate of $17 a month. However, each business was limited to a single light. These were controlled by a main switch, at the Pioneer Station, that would be turned on at dusk and off at midnight.[35]

The Pioneer Electric Power Company was dissolved because of three factors. First, financial difficulties brought on in part by the second, a surplus of power when the sought after industries did not relocate to Ogden. The final blow came about through adverse publicity and rumors that the company planned to head a gigantic combination to control power and dictate prices. Its successor, Union Light and Power was organized in 1897 and took over management of the Pioneer Station.[36]

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[34]Arrington, 396, gives the figure of 2 million cubic feet of lumber. This in fact is off by a factor of 20. The conduit was constructed with approximately 100,000 board feet of pine.

[35]Roberts, 83.

[36]The Circuit, October 1955, 7.

C. CONSTRUCTION CHRONOLOGY

During the four decades from 1890 to 1930, the population of Utah rose from 210,779 to 507,847 an increase of 241%. The population of Ogden however did not reflect the same trend. It's population grew from 14,889 (1890) to 40,272 (1930) an increase of 271%. This created an ever expanding demand on the limited water resources of the area.[37]

Under the terms of a contract dated March 1, 1929, between the United States and the State of Utah, studies were conducted to determine the feasibility of developing storage facilities to supplement the natural flow of the Ogden River for both irrigation and domestic purposes. The results of these investigations were reported in 1932 by E. O. Larson.[38]

Initial recommendations encompassed two plans. The first included constructing an earth and rock fill dam creating a reservoir with a capacity of 32,000 acre-feet (the second plan increased the capacity to 38,000 acre-feet by increasing the dam's height 4 feet); reconstructing the Utah Power and Light Company's 5-mile wood-stave conduit from the dam site to the mouth of Ogden Canyon (Figure 1); and constructing the South Ogden Highline Canal and the North Ogden Highline Canal (the name was changed to the Ogden-Brigham Canal in the final plans). The total cost for this plan was estimated at $2,324,000. In addition to the facilities outlined under the

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[37]Poll, 687-88.

[38]Bureau of Reclamation, Report on Ogden River Division, Salt Lake Basin Investigations, Utah, August 1932.

first, the second plan increased capacities and as a result would impact a larger area of land.

The first plan would affect approximately 12,950 acres of land that was already partially irrigated. Added to this 3,520 acres of new land would benefit, most of which would be used for growing wheat. Thirty percent of the partially irrigated lands and all of the new lands were located above existing canals carrying water north and south of the Ogden River (Figure 1). The second plan would allow an additional 1,750 acres of land to receive supplemental irrigation water. One thousand acres of new lands between Hot Springs and Brigham City would be irrigated for the first time. To accomplish this, the capacity of the conduit was increased from 250 second-feet to 280 second-feet. Also, the capacity of the northern canal was increased from 80 cfs to 120 cfs. Of the two plans, the second, with its increased capacities was eventually implemented.[39]

Two alternatives were put forth to convey water from the dam to the terminus of the Ogden-Brigham Canal and penstock. The first was to construct a pipeline the length of the canyon. The second, involved reconstructing the wood-stave conduit originally built by the Pioneer Electric Company in 1895-96 (HAER UT-51-22), to allow joint use by the power company and the water users. Of the two, Larson recommended replacing the existing conduit because of lower construction costs.

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[39]Bureau of Reclamation, Ogden River Division, A, B.

The existing conduit was 6 feet in diameter (72 inches) and constructed of Douglas Fir staves. Having been constructed in 1895-96, it was nearing a point where it would need replacement due to normal wear.

According to Larson, the conduit provided more water than needed for generating power at Utah Power and Light's Pioneer Station. By increasing the head pressure in the conduit, which would be afforded by the dam, he estimated that a 72-inch pipeline would be sufficient to meet the requirements of both the power company and the two canals. By the time final plans were developed, the flowline was increased to 75 inches.[40]

The cost of replacing the conduit was estimated at $443,000. The use of steel pipe was examined and found to be too expensive. Likewise, using the existing subgrade along the steep, solid rock canyon walls and through the seven short tunnels (HAER Photo UT-51-10) already used by the conduit proved to be more cost effective than laying a new grade (HAER Photo UT-51-20).

Preliminary discussions between the Bureau of Reclamation and Utah Power and Light engineers indicated the plan was feasible and equitable to both parties.[41] On October 18, 1934, a contract was worked out between the United States, the Ogden River Water Users' Association, the Utah Light and Traction

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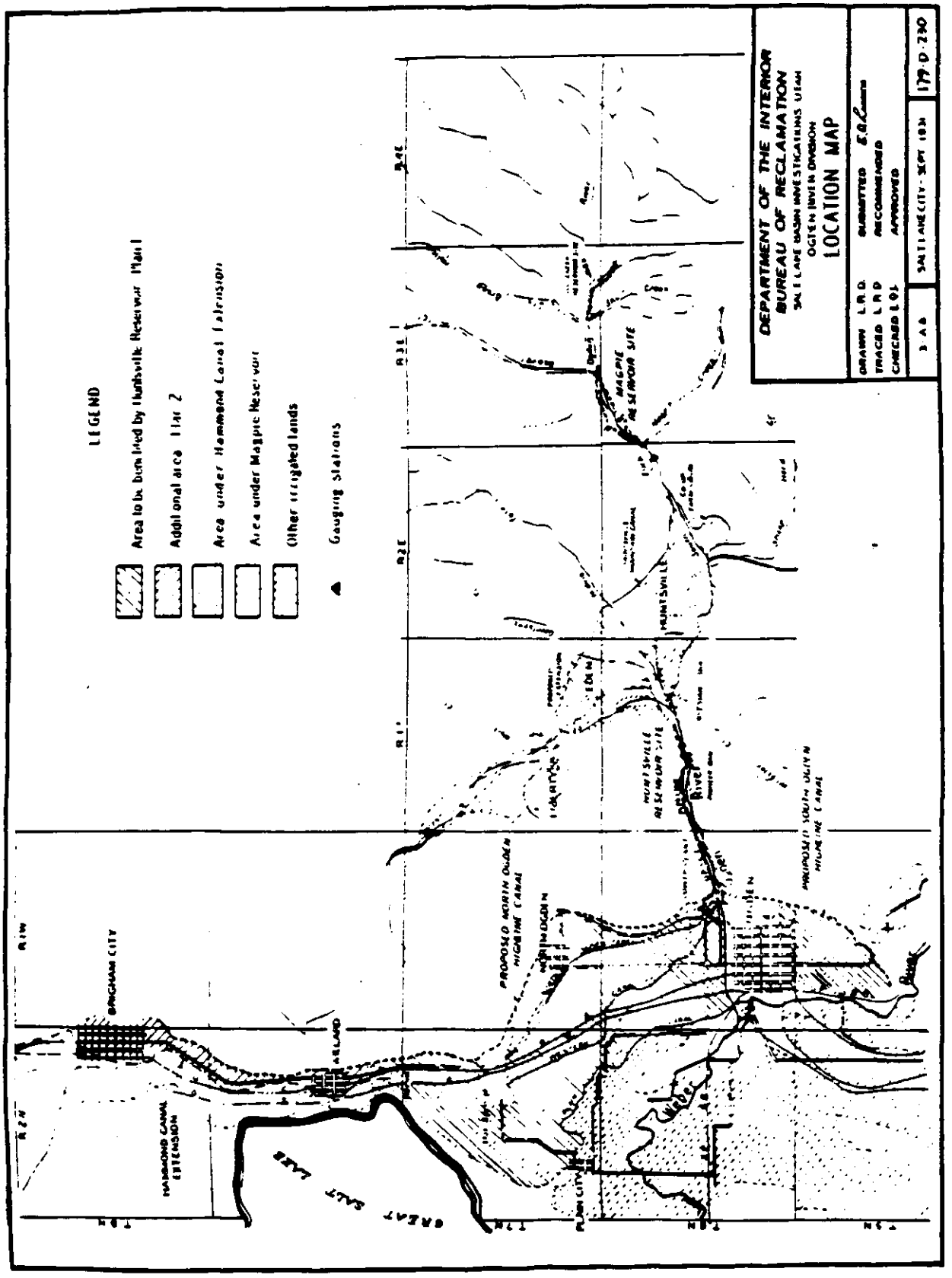
[40]Bureau of Reclamation, Project History, Ogden River Project, Utah, 1933, 10.

[41]Bureau of Reclamation, Ogden River Division, 11.

Figure 1


LEGEND
Area to be benefited by Huntsville Reservoir Plan I
Additional area Plan 2
Area under Hammond Canal Extension
Area under Magpie Reservoir
Other irrigated lands
Gauging Stations
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
SALT LAKE BASIN INVESTIGATIONS UTAH
OGDEN RIVER DIVISION
LOCATION MAP
DRAWN L.R.D.
TRACED L.R.D.
CHECKED E.O.L.
SUBMITTED
RECOMMENDED
APPROVED
SALT LAKE CITY - SEPT 1954
179-D-230
BRIGHAM CITY
ARLAND
HAMMOND CANAL EXTENSION
PROPOSED NORTH OGDEN HIGHLINE CANAL
NORTH OGDEN
HUNTSVILLE RESERVOIR SITE
EDEN
HUNTSVILLE
MAGPIE RESERVOIR SITE
PROPOSED SOUTH OGDEN HIGHLINE CANAL
PLAIN CITY
GREAT SALT LAKE
R1W
R1E
R2E
T7N
T6N

Company, and its leasee Utah Power and Light for reconstructing the conduit. The new flowline would supply water to both Utah Power and Light's Pioneer Station and the Ogden River Project. Under the terms of the contract, Utah Power and Light would repay 125/280 of the costs as they would receive 125 cfs of water from the total capacity of 280 cfs the conduit would supply. The project would be responsible for the remaining 155/280 of the cost.[42]

The Bernard-Curtiss Company of Minneapolis, Minnesota was awarded the contract for constructing the conduit (Specification No. 622) on May 2, 1935. The effective date of the notice to proceed was June 24, 1935.[43]

Work from Station 155+00 (15,500 feet) to 267+00 (26,700 feet) was sub-contracted to Dan Teters & Company and began ahead of schedule on June 5. Here, the work consisted of demolishing the old conduit and preparing the grade for new construction. The company was able to use a small power shovel to excavate the grade between Stations 240+00 (24,000 feet) to 267+00 (26,700 feet). However, the trench from Station 100+00 (10,000 feet) through Station 240+00 (24,000 feet) was excavated by hand. Pipe laying began at Station 216+00 (21,600 feet) and progressed toward the lower end. With the exception of a section through Tunnel 7, the conduit was laid through Station 267+00 (26,700 feet). The crews then returned to Station 155+00 (15,500 feet),

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[42] Project History, 1933, 26-28; Bureau of Reclamation, Project History, Ogden River Project, Utah, 1934, 43. The 1934 Project History lists the date of October 16, 1934 for the contract. Bureau of Reclamation records for Contract 11r-773 give the date as October 18, 1934.

[43] Bureau of Reclamation, Project History, Ogden River Project, 1935, 57.

laying pipe to Station 208+00 (20,800 feet). The section between Stations 208+00 (20,800 feet) and 216+00 (21,600 feet) could not be laid until several bridges were completed and a steel elbow had been installed.[44]

The upper portion of the conduit, from Stations 17+60 (1760 feet) to 155+00 (15,500 feet), was completed by the contractors, Bernard-Curtiss Company. This work was begun with the removal of the old pipe on June 10, 1935. Work laying the pipe began on August 31 at Station 17+60 (1760 feet) (HAER Photo 51-3) and was completed November 21 to Station 150 (150 feet). The line was backfilled but not tested because of cold weather.[45] Ryberg Brothers subcontracted to complete the conduit from the diversion tunnel outlet at the dam to Station 17+60 (1760 feet).[46]

The contract for constructing the surge tank (HAER Photo UT-51-16) and diversion works (Specification No. 747-D) was awarded to Ora Bundy of Ogden, Utah on December 6, 1935. Notice to proceed was set for January 2, 1936. Actual excavation began on December 21, 1935 and continued into 1936.[47]

During the construction of the new line, the existing line was demolished and the old staves and bands were salvaged. The first portion of staves were

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[44] Ibid.

[45] Ibid.

[46] Ibid., 53.

[47] Ibid., 59.

sold for $992.50 and the bands for $681.52. Additional sales of both staves and bands were in progress by the end of the year. Advance payments, totaling $1,650.00 were being held in special deposits for materials yet to be removed.[48]

Strikes in the lumber industry delayed completion of the project during 1935. Up to the time when cold weather stopped the work, most of the pipeline had been laid except in Tunnel 7 (HAER Photo UT-51-13), and in the section between Stations 208+00 (20,900 feet) and 216+00 (21,600 feet) where several structures, not required under the contract, had to be erected.[49] Once the weather warmed, the last section of conduit, totaling 700 feet, was assembled and the necessary backfilling completed. Following completion of the conduit, 5,886 acre-feet of water was delivered through the pipeline to the Pioneer Station in February 1937.[50]

On August 1, 1937, the Ogden River Project was turned over to the Ogden River Water User's Association by Secretary of the Interior, Harold L. Ickes. Two weeks later, on August 14, 1937, the Ogden River Water Users' Association held dedication services at the dam. The dedication address was delivered by R. F. Walter, the project's chief engineer.[51]

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[48]Ibid., 20.

[49]Ibid., 46-47.

[50]Bureau of Reclamation, Annual Project History, Ogden River Project, 1937, 10.

[51]Ibid, 11.

During 1938, members of Camp BR-64 of the Civilian Conservation Corps (CCC), at Heber City, began work on the Ogden River Project. Their efforts were largely confined to the two canals and finish work along Pineview Dam. Work performed by the CCC men on the conduit consisted of backfilling to protect some exposed sections, while other areas required the construction of timber shelters around the pipeline.[52]

During the night of March 18, 1939, a rockslide destroyed 525 feet of the conduit. Repairs were started 4 days later and completed by April 7. The damage was so extensive that water could not be delivered through the conduit while Ogden River Water Users' Association maintenance workers made repairs. Perhaps in anticipation of damage to the line, sufficient materials were kept on hand following the construction of the conduit for such an emergency.[53]

As the populations of Weber, Box Elder, and neighboring Davis and Morgan Counties continued to grow, it became necessary to develop the resources of the Ogden and Weber Rivers more fully. On August 29, 1949, Congress authorized the Weber Basin Project. This undertaking called for constructing four new reservoirs in addition to enlarging two existing reservoirs, including Pineview. To help obtain construction funds, the Weber Basin

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[52]Bureau of Reclamation, Annual Project History, Ogden River Project, 1938, 23.

[53]Bureau of Reclamation, Annual Project History, Ogden River Project, 1939, 10, 34, 35.

Conservancy District was organized on June 26, 1950, consisting of Weber, Davis, Morgan Counties, and a portion of Summit County. On December 12, 1952, the United States and the Conservancy District entered into a contract to enlarge Pineview Reservoir by about 65,000 acre-feet. This required increasing the height of the dam from 103 feet to 137 feet (HAER Photo UT-51-2). Construction began in 1955 and was completed in 1957 producing a reservoir having a holding capacity of 110,150 acre-feet.[54]

IV. THE OGDEN CANYON CONDUIT

A. DESCRIPTION

As outlined in the previous section, the Ogden Canyon Conduit (HAER Photo UT-51-12) was built to replace the aging 72-inch conduit used by Utah Power and Light. The new conduit would supply water to produce hydroelectric power and irrigation.

The conduit is 5 miles long, beginning at Station 17+60 (1760 feet) below Pineview Dam (HAER Photo UT-51-3), and ends at Station 284+00 (28,400 feet) at the surge tank (HAER Photo UT-51-16) (Figure 2). At Station 239+18 (23,918 feet) a steel siphon (HAER Photos UT-51-14, 15, 25, 26) splits from the conduit, carrying water across the mouth of Ogden Canyon to the South Ogden Highline Canal. At the surge tank, the water is divided, a portion of it going into an underground penstock for Utah Power and Light's Pioneer Station, and the remainder is diverted into the concrete-lined Ogden-Brigham Canal.

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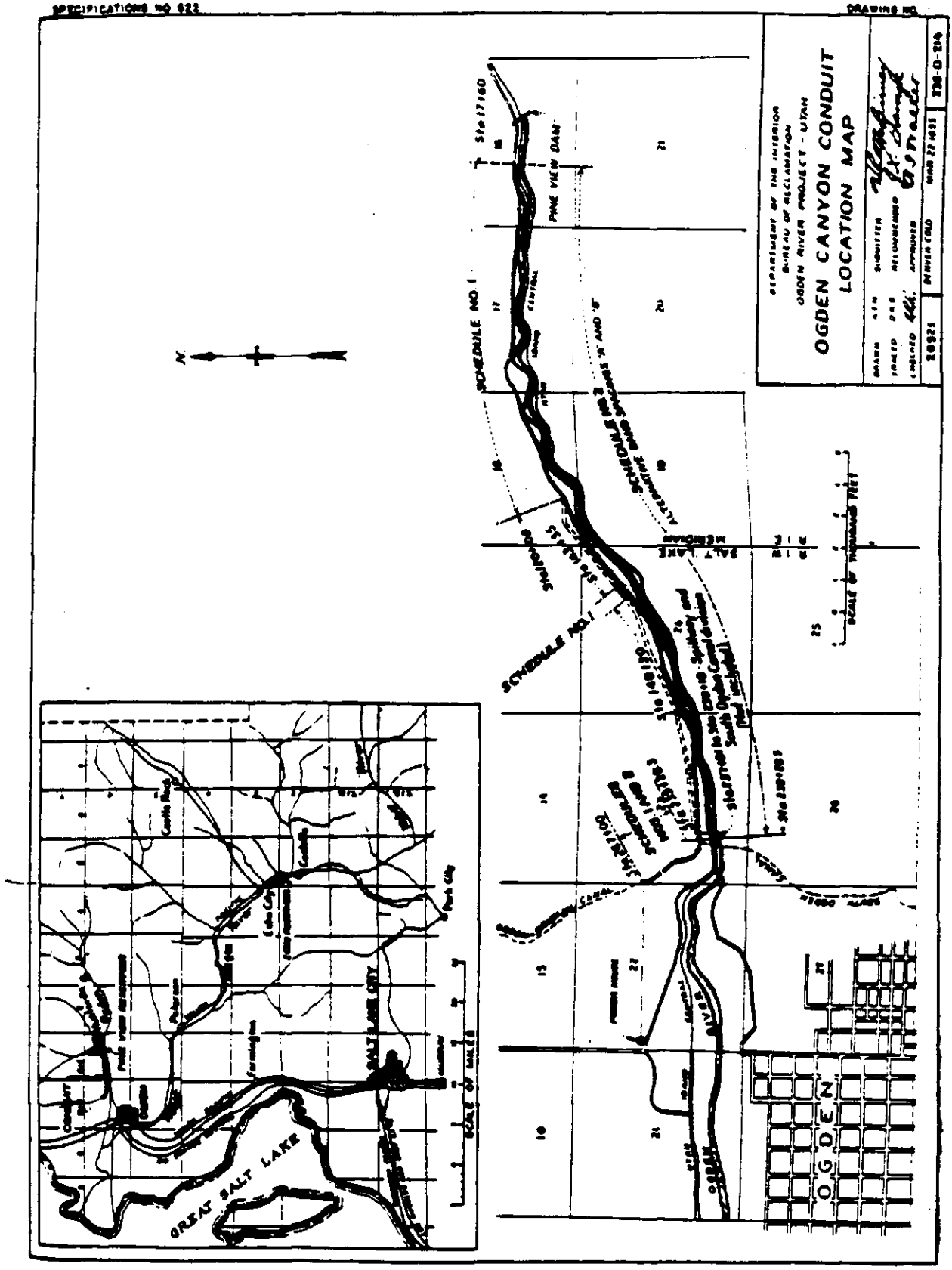
[54]Bureau of Reclamation, Ogden River Project, Utah, Proposed Rehabilitation and Betterment Program, Draft Report, April 1989, II-7.

Figure 2


OGDEN CANYON CONDUIT
LOCATION MAP
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
OGDEN RIVER PROJECT - UTAH
SCHEDULE NO 1
SCHEDULE NO 2
PINE VIEW DAM
OGDEN
GREAT SALT LAKE
SALT LAKE CITY

The conduit follows the north side of Ogden Canyon, above the river. Through its course, it travels through seven tunnels (Figure 3) and over six support structures. Each tunnel is secured by locked inspection access doors. The support structures consist of stone retaining walls, wood cradles and one bowstring truss and steel truss frame (HAER Photos UT-51-5, 22, 23, 24.)

In December 1986, a landslide damaged a section of the conduit and the trusses holding it in place. As a result, it has been replaced by metal pipe (HAER Photos UT-51-8, 9).

The wood-stave pipe construction is described in the project specifications as follows (Figure 4):

> The wood stave pipe shall be of continuous wood-stave metal-banded type, with metal tongues driven into slots in the ends of the staves to form butt joints. The inside diameter of the pipe after erection shall not be less than 75 inches.[55]
>
> The staves shall be made from 3- by 6-inch clear Douglas fir pipe stave lumber finished 2 inches thick, and shall be creosoted. The inside and outside faces shall be accurately milled to conform to the inside and outside radii of the pipe, and the edges beveled to true radial planes, and shall have small tongues and grooves on the edges. The ends of all staves shall be cut off perfectly square and slotted to receive the metal tongues for forming the butt joints. The slots shall be in exactly the same position in the ends of all staves and shall be cut to make a tight fit in all directions with the tongues. The staves shall have an average length of not less than 13 feet and staves shorter than 7 feet will not be accepted.[56]

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[55]Bureau of Reclamation, Schedules, Specification, and Drawings: Ogden Canyon Conduit, Specifications No. 622, 30.

[56]Ibid.

Figure 3

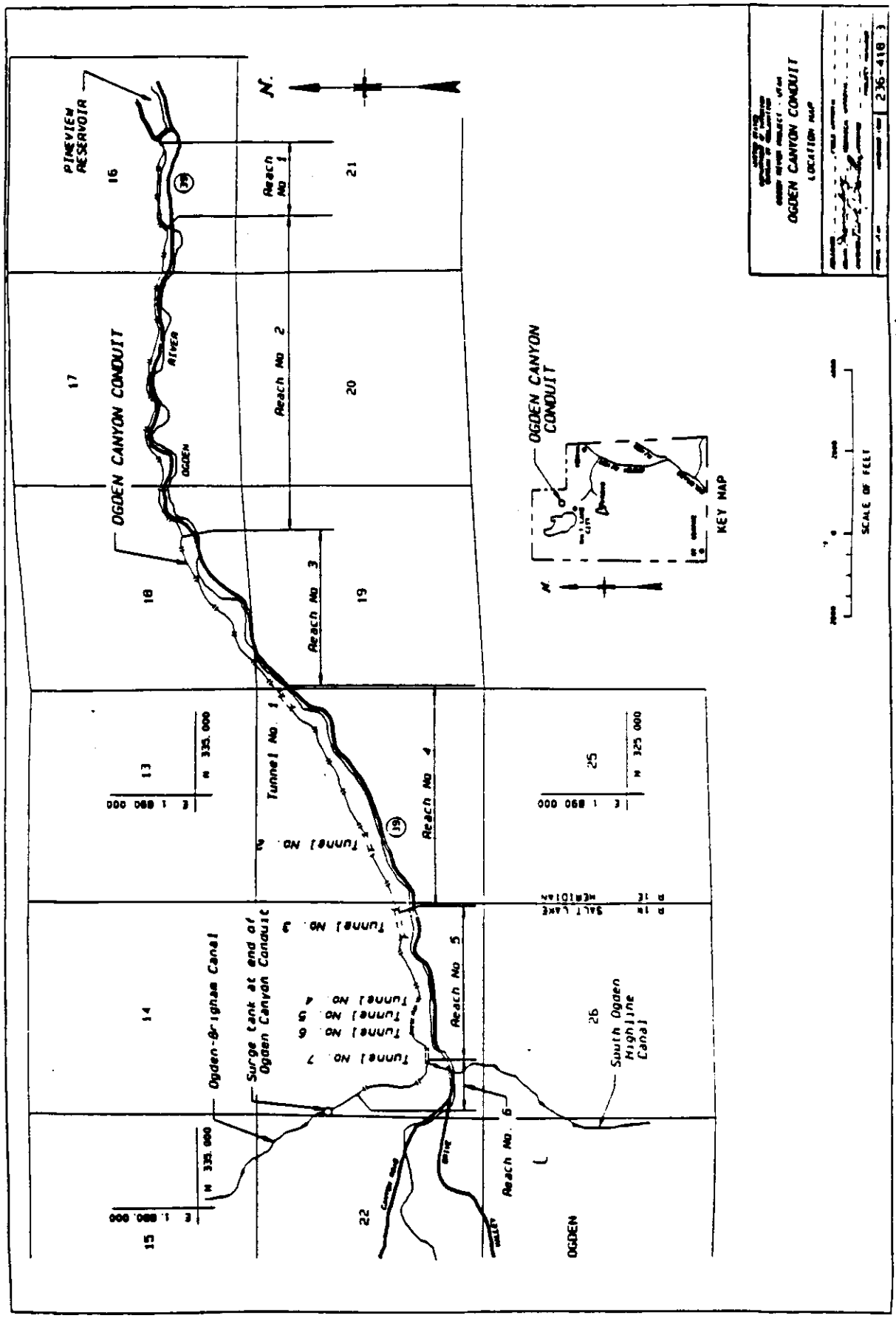
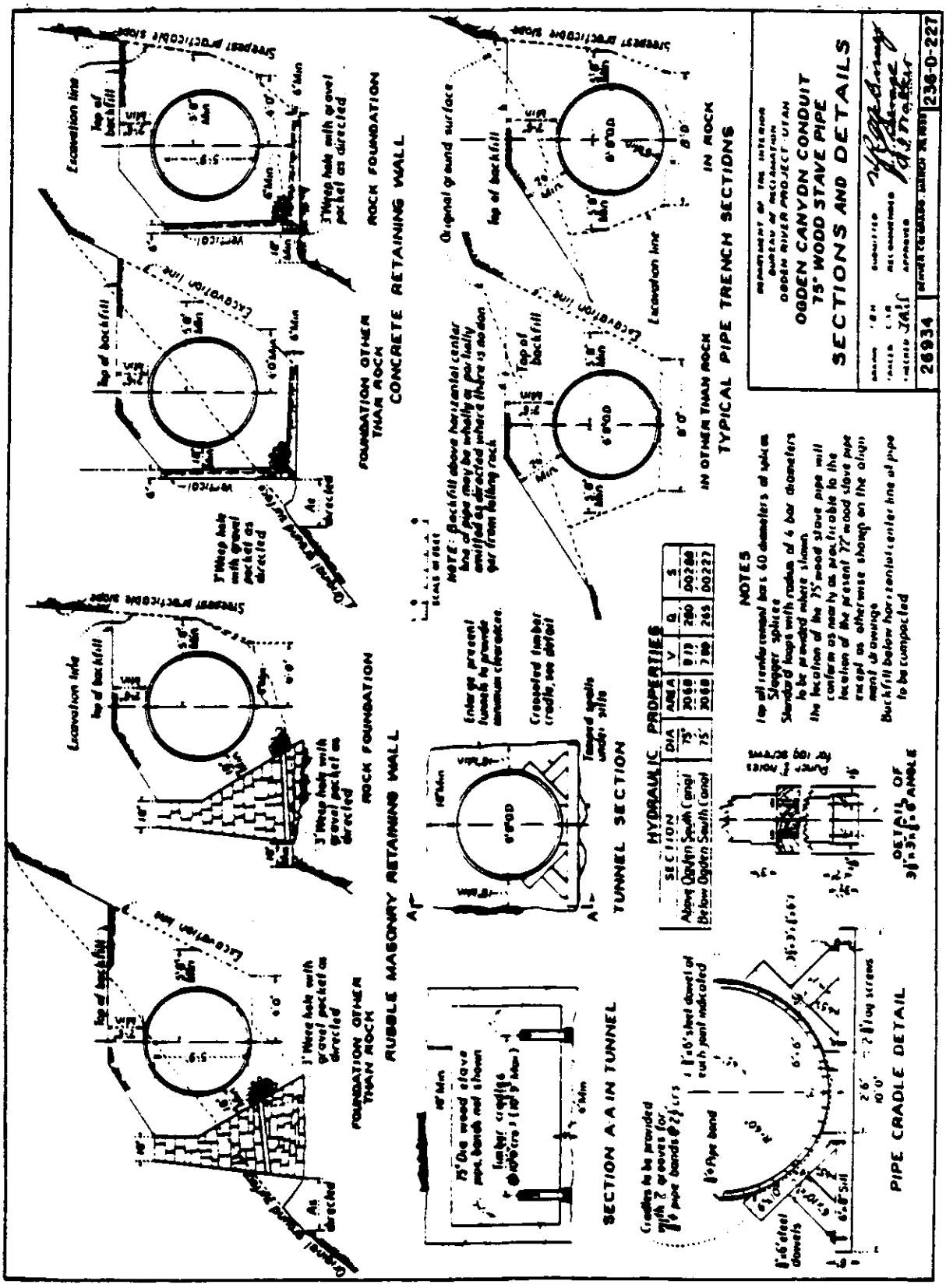

PINEVIEW RESERVOIR
OGDEN CANYON CONDUIT
Reach No 1
Reach No 2
Reach No 3
Reach No 4
Reach No 5
Reach No 6
Tunnel No 1
Tunnel No 2
Tunnel No 3
Tunnel No 4
Tunnel No 5
Tunnel No 6
Tunnel No 7
Surge tank at end of Ogden Canyon Conduit
Ogden-Brigham Canal
South Ogden Highline Canal
OGDEN
KEY MAP
SCALE OF FEET
N.

Figure 4


OGDEN CANYON CONDUIT
75" WOOD STAVE PIPE
SECTIONS AND DETAILS
26934
236-D-227
TYPICAL PIPE TRENCH SECTIONS
IN ROCK
IN OTHER THAN ROCK
CONCRETE RETAINING WALL
ROCK FOUNDATION
FOUNDATION OTHER THAN ROCK
RUBBLE MASONRY RETAINING WALL
TUNNEL SECTION
SECTION A-A IN TUNNEL
PIPE CRADLE DETAIL
DETAIL OF 30° & 22½° ANGLE
NOTES
HYDRAULIC PROPERTIES

> The pipe bands shall be of the two-piece type, each band consisting of a rod in two (2) pieces, two (2) shoes, nuts, and washers. All rods from pipe bands shall be 5/8-inch diameter round steel rods of structural steel conforming to Federal specification[s].[57]

These materials were assembled to form the conduit. The metal tongues were 12-gauge galvanized steel inserted into the stave ends with each end being offset from the two adjoining staves (HAER Photo UT-51-21). By not aligning adjacent stave ends, a stronger joint resulted. The tongue-and-groove sides also prevented slippage of the staves (Figure 5). A set of bands (2) were wrapped around the staves every 4 to 6 inches and connected with metal shoes curved to fit the pipe (HAER Photo UT-51-17). The shoe was designed to hold the head of one band while the threads and nut of the second passed through it to allow tightening. The bands were positioned so that the shoes were parallel to the ground at the sides (HAER Photo UT-51-17).[58]

B. MODIFICATIONS

A variety of modifications have been required during the last decade. An Emergency Rehabilitation and Betterment Loan was needed in December of 1982, and approved in early 1983, to repair damage to the surge tank and the Utah Power and Light Pioneer Station penstock caused by a landslide. The following year on April 1, 1984, approximately 600 feet of the conduit was destroyed by a landslide. This break posed a serious threat to the water users because the

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[57] Ibid., 31.

[58] Don Southworth, "Historic American Engineering Record: Ogden Canyon Conduit," Bureau of Reclamation manuscript, February 1988, 8.

irrigation season was fast approaching. By June, 750 linear feet of the conduit was replaced with 975 linear feet of 72-inch mortar-coated steel pipe bypassing the slide area.[59] Finally, in December 1986, the 1983 Emergency Rehabilitation and Betterment Loan was again amended to allow the replacement of 208 feet of conduit and to rehabilitate a steel trestle supporting it.[60]

Because of the age of the conduit, over 50 years, and the need for four emergency loans in 3 years, the Bureau of Reclamation requested the Ogden River Water Users' Association to consider major rehabilitation or replacement of the conduit. To further the request, Reclamation informed the Ogden River Water Users' Association that unless this action was undertaken, future emergency loans may be denied.[61]

In the spring of 1986, it was necessary to replace an additional 300 feet of the wood-stave conduit with 78-inch diameter concrete pipe. This repair was undertaken without assistance from the Reclamation Emergency Loan Program.[62]

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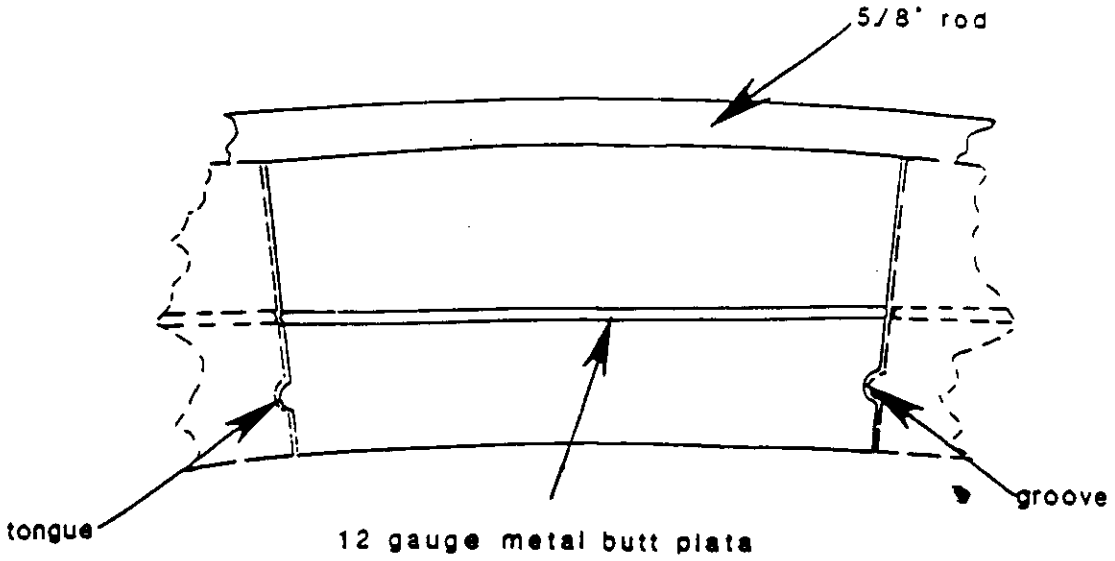
[59]Bureau of Reclamation, Proposed Rehabilitation and Betterment Program, 1989, II-1,12.

[60]Ibid., II-12.

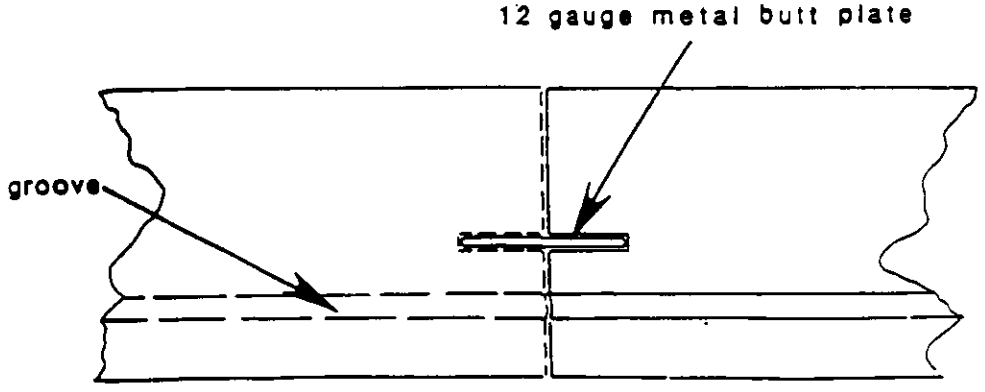
[61]Ibid.

[62]Ibid.

Figure 5



WOOD STAVE



WOOD STAVE BUTT JOINT

C. OWNERSHIP AND FUTURE

Ownership of the Ogden River Project was transferred to the Ogden River Water Users' Association on August 1, 1937.[63] From that point, until December 1982, the Ogden River Water Users' Association had funded rehabilitation and maintenance activities. Beginning in December 1982, a number of modifications and repairs were necessary requiring the assistance of the Bureau of Reclamation.

Because of a lifespan exceeding half a century, the conduit is showing signs of extreme wear (HAER Photo UT-51-6). Ed Southwick, consulting engineer to the Ogden River Water Users' Association, said the flowing water has caused the interior of the line to rot adding to its already poor condition.[64] In addition, land and rock slides have already necessitated the replacement of large sections of the conduit with steel and concrete pipe. The system is also prone to leaking, which is repaired using wooden patches (HAER Photo UT-51-18). Thus, the continued exposure to the elements both within and without the conduit, and the numerous stop-gap repairs that have been made, has left the entire system on the verge of complete failure.

As outlined in the preceding section, these repairs became more frequent

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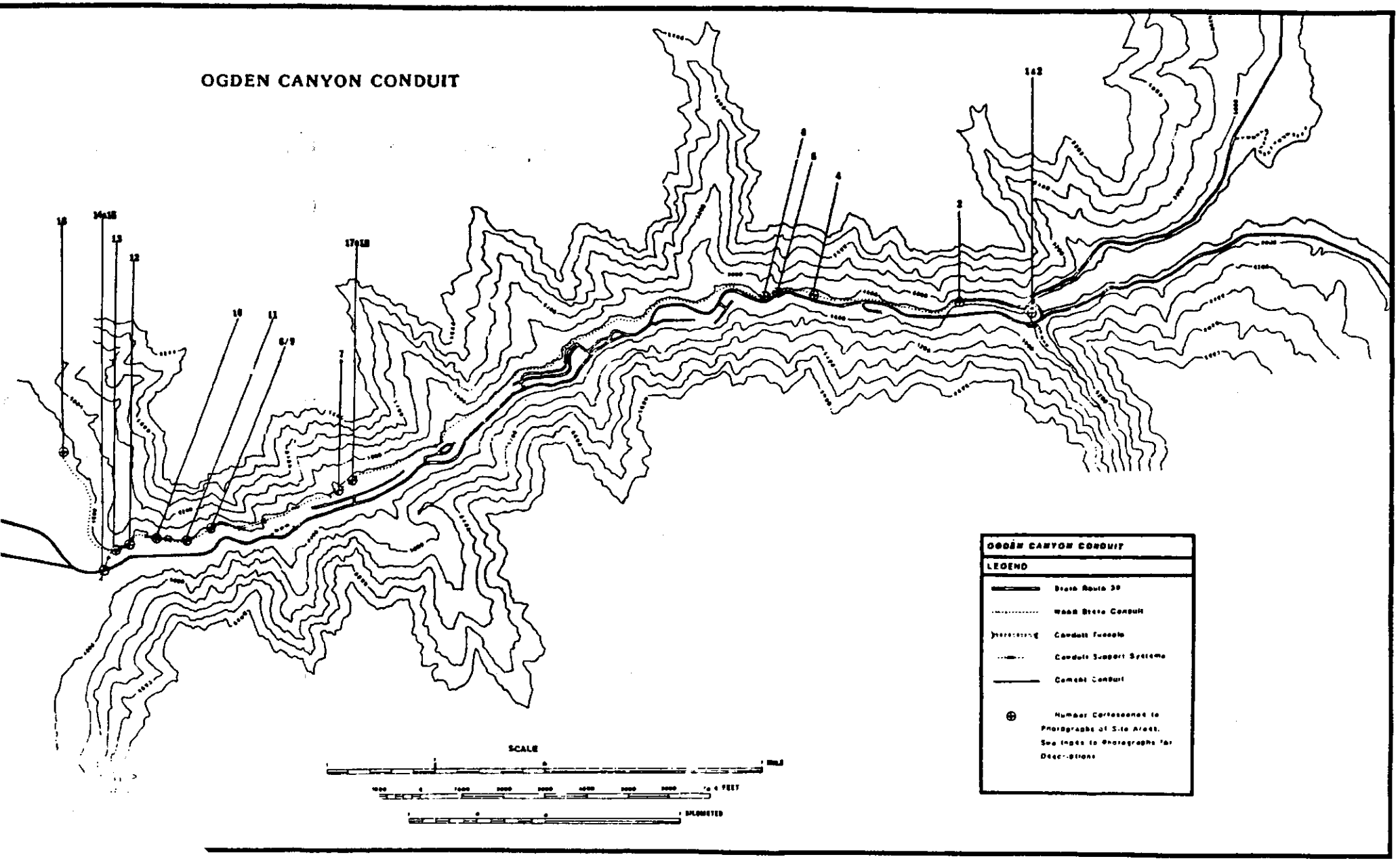
[63] Project History, 1937, 11.

[64] Southworth, 9.

and costly resulting in the recommendation that the Ogden River Water Users' Association examine major rehabilitation measures or replacement of the conduit. After consulting with the Bureau of Reclamation, both parties agreed that the pipeline must be replaced.

The Bureau of Reclamation, the River Water Users' Association, and Utah Power and Light support plans to replace the entire length of the conduit. The new system will continue to serve the Utah Power and Light Pioneer Station and the Ogden River Water Users' Association's two irrigation canals.


OGDEN CANYON CONDUIT
OGDEN CANYON CONDUIT
LEGEND
Utah State Conduit
Conduit Supports
Concrete Conduit
SCALE
FEET